Concise Explanation of documents

Excerpted English translation of JP-A-3-57588

From line 1 in upper left column on page (3) to line 4 in upper right column on page (3), and Tables 1 and 2

Examples of the present invention will be described hereinafter.

TABLE 1

Alloy No.		Chemical composition (wt%)					
		Si	Zn	Cu	Fe	Ti	Al
Example of this invention	1	10.0	12.5	11.5	-	-	Balance
	2	11.2	9.8	10.5	0.8	-	Balance
	3	11.0	10.0	10.0	0.8	0.05	Balance
Comparative example	4	10.1	4.8	10.0	-	-	Balance
	5	10.0	10.0	4.0	-	-	Balance

Filler alloys comprising cast wires of the aluminum alloys having respective compositions shown in Table 1 were manufactured.

Then, the solidus and liquidus line temperatures of the filler alloys obtained as described above were investigated. The results are shown in Table 2 below.

Subsequently, brazing ability was evaluated using

each filler alloy above. A pipe made of a 6063 grade aluminum alloy was assembled with an AC4C grade aluminum cast block with each filler alloy disposed on bonded section of the assembly, which was blazed using a chloride based flux in a furnace by setting the atmospheric temperature of the furnace at 555 to 560°C. The appearance of the bonded section after brazing was observed with the naked eye. The results are shown in Table 2.

TABLE 2

Sample No.		Solidus temperature (°C)	Liquidus temperature (°C)	Evaluation of brazing (Note)
Example of this invention	1	490	535	○
	2	495	538	○
	3	495	540	○
Comparative example	4	520	562	×
	5	516	560	×

(Note): ○••• Good fillets were formed at the bonded section.

×••• Fusion of the filler alloy was so insufficient that no fillets were formed.

Excerpted English translation of JP-A-6-226489

From line 2 in right column on page (3) to line 9 in left column on page (4), and Table 2

[0014]

[Example] Examples of the present invention will be described below.

Example 1

Test pieces 1 for the solder bonding test having a shape as shown in Fig. 1 were assembled using an Al sheet (JIS 1100 alloy), a Cu sheet (0.03% Zr in Cu) and a Fe sheet (JIS G3101), each having a thickness of 0.5 mm, and the assemblies were bonded using the solder alloy of the present invention. The solder alloy to be used comprised of 40 wt% of Sn, 5 wt% of Al and a balance of Zn, and the solder was melted in a graphite crucible. Each sheet of the above was cut into a dimension of 30 x 30 mm and, after coated with a flux mainly comprising zinc chloride, the sheet was immersed in a molten bath of the solder alloy of the present invention kept at a temperature of 400°C, to form each solder coated sheet 2. Alternatively, each sheet after treating as described above was cut into a dimension of 20 x 40 mm and bent into a L-shape. After coating the L-shaped block 3 with the flux, it was placed on the solder-coated sheet 2, to assemble the test piece 1 for the solder bonding test. The test piece 1 for the

solder bonding test obtained as described above was inserted into a furnace at 400°C and heated for 15 minutes, thereby bonding the solder coated sheet 2 to the L-shaped block 3 with the solder. In comparative examples, each sheet material was immersed in a molted Zn bath kept at 450°C and, after forming a solder-coated sheet 2, each test piece 1 for the solder bonding test was assembled in the same manner as in the examples according to the present invention. The test piece 1 for the solder bonding test obtained as described above was inserted into a furnace at 450°C and heated for 15 minutes, thereby bonding the solder-coated sheet 2 to the L-shaped block 3 with the solder. Regarding these test pieces, bonding states between each solder-coated plate 2 and L-shaped block 3, and the surface states of each bonded section were inspected with the naked eye. The results are shown in Table 1.

[0015]

[TABLE 1]

	Sample No.	Bonded sheet material	Bonding state *1	Surface state *2
Example of this invention	1	Al	○	○
	2	Cu	○	○
	3	Fe	○	○
Comparative example	4	Al	×	×
	5	Cu	○	×
	6	Fe	×	×

*1 ○: good bonding

×: poor bonding (for example, the sheets were only partially bonded)

*2 ○: no change of color

×: severely oxidized and dirty

[0016] Table 1 clearly shows that both the bonding state (soldering ability) and surface state are good in the examples 1 to 3 according to the present invention. On the contrary, the solder was severely oxidized with dirty surface appearance in the comparative examples 4 to 6. In addition, Al and Fe were only partially bonded irrespective of high heating temperature (450°C) of these metal sheets.

[0017] Example 2

A perforated tube was formed by extrusion using a JIS 1100 alloy (Al with 0.12 wt% Cu), and a coating of a Zn-based alloy having a composition, shown in Table 2,

with a thickness of about 30 to 40 μm was coated on the outer surface of the tube with the aid of ultrasonic wave. As shown in Fig. 2, the perforated tube (4) was bent to form a meandering tube, and a fin material (5) comprising a corrugated sheet of a JIS3003 alloy (Al containing 0.12 wt% of Cu and 1.2 wt% of Mn) was inserted between meandering portions of the tube. The tube and fin material was bonded at each temperature shown in Table 2, thereby assembling a Serpentine type condenser. In the comparative examples, a conventional blazing sheet having a core material of a JIS 3003 alloy and a sheath material of a JIS 4045 alloy (Al with 10 wt% Si) was used as the fin, and a Serpentine type condenser was assembled by a conventional method.

Table 2

	No.	Coated sheet composition (wt%)			Liquidus temperature (°C)	Temp. while bonding (°C)	Bonding state *1	Fillet-shape *2
		Sn	Al	Zn				
Example of this invention	11	12	3	Balance	376	410	A	A
	12	15	3	Balance	373	400	A	A
	13	15	5	Balance	363	395	A	B
	14	15	8	Balance	377	410	A	B
	15	30	5	Balance	345	380	A	A
	16	50	5	Balance	323	350	A	A
	17	65	5	Balance	305	340	A	A
Comparative example	18	8	5	Balance	380	410	C	D
	19	15	1	Balance	384	410	B	C
	20	15	12	Balance	398	430	C	D
Conventional example	21	Fin is blazing sheet			590	600	A	A

*1 A: good bonding, B: partially bonded, C: bonding was impossible

*2 A: Good fillet was continuously formed

B: Good fillet was partially formed

C: Fillet was incompletely formed (alloy blocks for bonding was not sufficiently swelled)

D: Fillet was not formed at all

Excerpted English translation of JP-A-8-215579

From line 30 in right column on page (3) to line 12 in right column on page (4), and Fig. 1

[0016]

[Example] The method for manufacturing the metal carrier for catalyst devices of the present invention will be described hereinafter with reference to the drawings. Fig. 1 is a graph showing the relation between the temperature in the furnace and time, in one example of the method for manufacturing the metal carrier for catalyst devices of the present invention. Fig. 2(A) illustrates a cross section of bonded section of the honeycomb body manufactured by the method of the present invention, and Fig 2(B) is a graph showing the hardness distribution on a plane along the line $Y-Y_1$ in Fig. 2(A). In Fig. 1, the vertical axis denotes the temperature c, and the

horizontal axis denotes the time t. The solid line and broken line in the graph show the relations between the temperature and time at the outer part and at the center, respectively, of the furnace. The points P on each line is represented by coordinates (c, t). The solid line representing the relation between the temperature and time at the outer part of the furnace is composed of a first step heating curve h_{0-1}, a pre-heating curve h_{1-2}, a second step heating curve h_{2-3}, a bonding curve h_{3-5} and a cooling curve h_{5-7}. The solid line passes each point in the order of $P_0(c_0, t_0)$, $P_1(c_1, t_1)$, $P_2(c_1, t_2)$, $P_3(c_3, t_3)$, $P_5(c_3, t_5)$ and $P_7(c_0, t_7)$ with the lapse of time t. The broken line representing the relation between the temperature and time at the center of the furnace is composed of a first step heating curve h_{0-2}, a second step heating curve h_{2-4}, a bonding curve h_{4-6}, and a cooling curve h_{6-7}, and passes each point in the order of $P_0(c_0, t_0)$, $P_2(c_1, t_2)$, $P_4(c_3, t_4)$, $P_6(c_3, t_6)$ and $P_7(c_0, t_7)$ with the lapse of time t.

[0017] As described above, a temperature difference is caused between the outer part and center of the furnace, because a high-vacuum furnace is used in order to prevent the bonded section of the sheet by brazing from being oxidized. In the vacuum furnace, since the honeycomb body placed in the furnace is heated with radiation from the

heat source, and is not heated by conduction and convection, a temperature distribution is generated to caused a temperature difference between the outer part of the furnace, which is close to the heat source, and the center of the furnace. In other words, when the inside of the vacuum furnace in which the honeycomb body to be bonded is inserted is heated from the state represented by $P_0(c_0, t_0)$, the outer part of the furnace is heated by radiation, and the temperature thereof increases along the first step heating curve h_{0-1}. On the contrary, temperature increment is retarded at the center part of the furnace that is remote from the heat source, and the temperature increases along the first step heating curve h_{0-2}.

[0018] Since the temperature increase at the outer part of the furnace is faster than that at the center of the furnace in the vacuum furnace as described above, the temperature increase at the outer part is temporarily suppressed in the manufacturing method of the present invention to wait for the temperature increase at the center of the furnace. For this purpose, heating of the inside of the furnace is halted or adjusted so that the temperature at the point P_1, where the temperature c_1 has been attained at the time t_1 on the point P_1 on the first

step heating curve h_{0-1}, is not increased above the temperature c_1. Consequently, the temperature in the furnace is averaged at the temperature c_1 when the first step heating curve h_{0-2} at the center of the furnace has reached the temperature c_1 after a time interval T_1 (= $t_2 - t_1$). The temperature c_1 and the time T_1 (= $t_2 - t_1$) are named herein as a pre-heating temperature and pre-heating time, respectively. The pre-heating temperature c_1 is usually adjusted to be lower by about 50°C than the solidus temperature c_m of the brazing material, by taking overshoot of the furnace (represented by a curve h_8) and irregularity of thermocouples into consideration. The solid line h_{1-2} connecting between the points P_1 and P_2 corresponds to a pre-heating curve, which indicates the relation between the temperature and time during the pre-heating time T_1 at the outermost part of the furnace. The interval of the pre-heating time T_1 is determined by experiments since it differs depending on the conditions such as the dimensions of the furnace and the objects to be heated, and the time is usually set at 10 to 120 minutes.

[0019] When the inside of the furnace is again heated at the point P_2 where the temperatures at the outer part and the center of the furnace have been averaged, as shown

in the second step heating curve h_{2-3} and h_{2-4}, the temperature can reach the points P_3 and P_4 on the bonding temperature curve c_3 of the filler alloy without causing a not so large time lag ($t_4 - t_3$) for heating the outer part and the center of the furnace. The bonding temperature c_3 is set to be higher than the solidus line temperature c_m of the filler alloy and lower than C_n (the liquidus line temperature + 50°C).

[0020] A heating speed of 6°C per minute or more is preferable considering the relations between the temperature and time as shown in the above first step heating curve h_{0-1} and second step heating curve h_{2-3}, in order to suppress the depth of diffusion of the filler ally into the base material within the thickness of the base material.

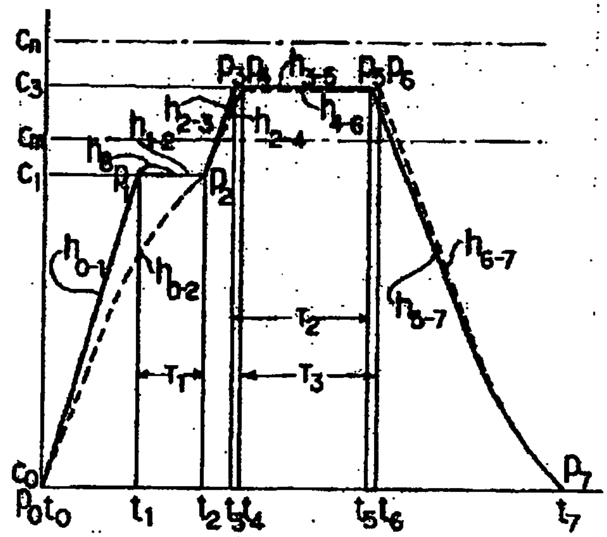
[0021] For bonding with the filler alloy, the temperature in the furnace is kept at a given bonding temperature c_3, during a given bonding time T_2 that is 90 minutes or shorter, in order to restrict the depth of diffusion of the filler alloy into the base material to a prescribed depth of 20 μm or less or within the thickness of the base material. The relation between the temperature and time at the outer side of the furnace is shown by the bonding curve h_{3-5} (the solid line)

connecting between the points P_3 and P_5. While the center of the furnace is also kept at a given bonding temperature c_3, a slight time lags $(t_4 - t_3)$ and $(t_6 - t_5)$ arise in the bonding time T_3 at the center relative to the bonding time T_2 at the outer part of the furnace. This relation between the temperature and time is represented by the bonding curve h_{4-6} (the broken line) connecting between the points P_4 and P_6. However, since the time lags $(t_4 - t_3)$ and $(t_6 - t_5)$ are smaller than the bonding time T_2 at the outer part of the furnace and the bonding time T_3 at the center of the furnace, no difference in the bonding time is substantially observed between the outer part and center of the furnace, also causing no difference in the diffusion depth of the filler alloy between the two parts.

[Brief description of the Drawing]

[Fig. 1] Fig. 1 is a graph showing the relation between the temperature in the furnace and the time, in the method for manufacturing the metal carrier for catalyst devices of the present invention.

[Fig. 1]


Cn
C3
Cm
C1
C0
p3 p4
h3-6
p5 p6
h2-3
h2-4
h4-6
h1-2
h8
p1
p2
h0-1
h0-2
h6-7
h5-7
T1
T2
T3
p7
p0 t0
t1
t2 t3 t4
t5 t6
t7